INTERFERENCES and ACCURACY Review

The UV fluorescence technique monitors the intensity of light emitted from the passing stream at a selected wavelength band.

This technique can be quite selective by eliminating the light affect of compounds in the water that do not share the same fluorescence characteristics of hydrocarbons;

1. When chemical compounds in the water are excited with light energy, only certain compounds will emit the light back out of the water at a higher wavelength than excited with. These are referred to as fluorescing compounds. The HydroSense does not respond to most chemicals because it only responds to fluorescing compounds, of which aromatic hydrocarbons are included.

2. The light used to excite the compounds is filtered to a specific wavelength. Of all the fluorescing compounds only certain ones will respond to this wavelength. Some respond to higher and some to lower wavelengths. This filter narrows the HydroSense response further to only those that fluoresce from this chosen wavelength

3. These limited number of compounds that do fluoresce from the light may emit light at any number of wavelengths such as 290nm, 310 nm, 350 nm 480nm, etc. Aromatic hydrocarbons happen to fluoresce at a common wavelength band. By filtering the light sensor from all light except this band, only compounds that emit this wavelength are picked up by the receiver.

4. Oil and Grease in water may be made up of hundreds or thousands of different hydrocarbon compound structures. The aromatic compounds tend to be the fluorescing compounds. Typically, these hydrocarbons will include one or more benzene rings in their make-up. Further, these are usually found with a carbon chain length of about C-5 to C-36 and include BTEX, crude oil, refined oils (lubricants, grease), gasoline, diesel, Jet A, etc. The proportion of aromatics within the total hydrocarbons is generally consistent in a product or process. The aromatics are therefore used as an indicator to correlate the monitor to total hydrocarbons in water.

Synthetic oils, vegetable oils, mineral oils, and animal fats, and glycol inherently do not fluoresce at the targeted wavelength since they do not contain a hydrogen and carbon molecule. However, they may carry a dye or additive that does fluoresce in the same wavelength. In these cases, this interferent may be used as a tracer to indicate the oil.

Changing Oil Types and Sources

Different oils have a different make-up of compounds and the fluorescing strength may vary between oil types. For instance, diesel fuel may fluoresce much stronger than transformer oil. If the HydroSense is calibrated using 100 ppm of diesel, 100 ppm of transformer oil may only give a display reading of 95 ppm.
Crude oil may vary from one well to another, lubricating oils from different manufacturers may vary in their make-up, oils may be dissolved or free, and so on.

The calibration is therefore site selective and should be done using actual process water or with samples of oil that are to be targeted by the monitor.
The calibrated accuracy relies on the oil type and conditions being consistent. The HydroSense will respond positively to aromatic hydrocarbons but the display accuracy may be affected by variations in the types and sources of these hydrocarbons.

Other Chemicals in the Water

The light sensor is selective to compounds in the water that emit light at specific wavelengths of light energy. If there is a background chemical in the water that also fluoresces at these wavelengths, the Hydrosense will respond to them.
If this background chemical concentration is consistent, this interference will be zeroed out during calibration. Calibration is recommended using process water so that any background interferents are zeroed out.

If an interfering background chemical changes in concentration, the HydroSense will sense this change. Consideration to this affect is important for alarms and recording. Filtering of the water, changes to chemical use, or special light filtering may be required to provide more stable readings.

The periodic introduction of fluorescing chemicals into the water may also affect the reading. During these conditions, operators and alarms should be acknowledged that nuisance alarms may occur. Soap manufacturers will often include fluorescing dyes in the product for appearance and identification. Green dyes are typical in industrial degreasers and commercial soaps. Fluorescing chemicals are often included in detergents to enhance the visual affect of a cleaned product such as clothes.

Not all of these commercial dyes will affect the wavelengths of the HydroSense, however, green dyes have proven to be a common interferent.

Suspended Solids and Turbidity

The unit is calibrated to a passing stream of water. The amount of light fluoresced by the aromatic hydrocarbons determines the calibration parameters. The light received by a hydrocarbon and then sent back to the receiver is based on a stable light path through the water. If suspended solids or turbidity block the light getting to the hydrocarbon, light cannot be fluoresced back to the sensor. Readings can be dampened by an increase in solids or turbidity. When process water is used during the calibration, the offset affect of solids is taken into account and zeroed out.

The design of the large surface sensing area of fluid verses the small sensing depth minimizes the affect of turbidity in the HydroSense. In effect, the hydrocarbons have little place to hide behind solids. In circumstances of dramatic changes in turbidity, sample conditioning techniques prior to the HydroSense should be considered.